

This Application is a continuation of U.S. Patent Application No. 09/771,031, filed January 26, 2001, by Marwan Abboud, et al., entitled COOLING SYSTEM, now allowed, which application claims priority from and is a continuation-in-part of U.S. Patent Application No. 09/638,208 filed August 11, 2000, by Marwan Abboud, et al., entitled COOLING SYSTEM, now allowed, which application claims priority from and is a continuation-in-part of U.S. Patent Application No. 09/489,646, filed January 24, 2000, by Jean-Pierre Lalonde, et al entitled CLOSED LOOP CATHETER SYSTEM, now issued Patent No. 6,383,180, issued May 07, 2002, which application claims priority from U.S. Provisional Patent Application No. 60/117,175, filed January 25, 1999, by Marwan Abboud, et al., entitled CRYOABLATION SYSTEM, now expired, all of which are incorporated herein by reference.

IN THE CLAIMS

Claims 1-20 (cancelled).

Claim 21. (New). A medical cooling system for affecting the temperature of a treatment site, comprising:

- a medical device;
- a coolant supply;
- a first coolant flow path between the medical device and the coolant supply;
- a chamber disposed about the portion of the first coolant flow path and having an inlet and an outlet;
- a flow splitter in the first coolant flow path upstream of the chamber;
- a second coolant flow path between the flow splitter and the inlet;
- a first valve in the first coolant flow path,
- a second valve in the second coolant flow path, and
- a programmable controller coupled to a temperature sensor in the chamber, and coupled to the first and second valves, the programmable controller controlling the flow of coolant through the first and second flow paths to regulate the temperature of the treatment site.

- Claim 22. (New). The medical cooling system of claim 22,  
wherein the programmable controller establishes a duty cycle to specifically regulate temperature increases and decreases at the treatment site.
- Claim 23. (New). The medical cooling system of claim 22,  
wherein the programmable controller controls a freezing rate of the medical device.
- Claim 24. (New). The medical cooling system of claim 22,  
wherein the programmable controller controls a thawing rate of the medical device.
- Claim 25. (New). The medical cooling system of claim 22, further comprising:  
one or more distal sensors in the medical device in communication with the programmable controller,  
wherein the programmable controller controls the first and second valves in response to a reading from the one or more distal sensors for application of specific temperature regimens at the treatment site.
- Claim 26. (New) A medical cooling system comprising:  
a coolant supply unit, and a medical device having distal and proximal ends;  
a controller, the controller being connected to the medical device at a connection point on the proximal end of the medical device;  
a first cooling system directing coolant from the coolant supply to the medical device at a first temperature along a coolant supply line through the connection point;  
a second cooling system chilling the coolant within a portion of the coolant supply line upstream of the connection point to a temperature below the first temperature, the second cooling system including an enclosure having a fluid inlet and a fluid outlet, the enclosure defining a fluid path from the inlet to the outlet, and the enclosure enveloping the portion of the coolant supply line;  
wherein the inlet is provided inside the enclosure; and  
wherein the enclosure is disposed in a system component external to the coolant supply unit.

Claim 27. (New) The medical cooling system of claim 26,  
wherein the system component is a connection box disposed along the coolant supply line  
upstream of the connection point.

Claim 28. (New) The medical cooling system of claim 27,  
wherein the connection box is an ECG connection box.

Claim 29. (New) The medical cooling system of claim 26,  
wherein the system component is attached to an external surface of the coolant supply  
unit.

Claim 30. (New) The medical cooling system of claim 26,  
wherein the controller is disposed in the coolant supply unit.

Claim 31. (New) A subcooler for a refrigerant flow path in a medical cooling system for  
controlling the temperature of a medical device, comprising:  
a chamber disposed about a portion of the refrigerant flow path and having an inlet and  
an outlet;  
a flow splitter in the refrigerant flow path upstream of the chamber;  
a secondary flow path between the flow splitter and the inlet;  
a programmable controller coupled to a temperature sensor in the chamber, the  
programmable controller controlling the flow of refrigerant through the refrigerant flow path and  
the secondary flow path to regulate the temperature of the medical device.

Claim 32. (New) The subcooler of claim 31, further comprising:  
a first valve in the refrigerant flow path,  
a second valve in the secondary flow path,  
wherein the programmable controller is coupled to the first and second valves.

Claim 33. (New) The subcooler of claim 31, further comprising:  
wherein the programmable controller establishes a duty cycle to specifically regulate  
temperature increases and decreases of the medical device.

Claim 34. (New). The medical cooling system of claim 31,  
wherein the programmable controller controls a freezing rate of the medical device.

Claim 35. (New). The medical cooling system of claim 31,  
wherein the programmable controller controls a thawing rate of the medical device.

Claim 36. (New) A medical cooling system, comprising:  
a coolant supply unit, and a medical device having distal and proximal ends;  
a controller, the controller being connected to the medical device at a connection point on  
the proximal end of the medical device;  
a coolant supply line disposed through the connection point between the medical device  
and the coolant supply;  
a thermo-electric subcooler having a first heat exchanging surface and a second heat  
exchanging surface, the second heat exchanging surface being cooler than the first heat  
exchanging surface, the second heat exchanging surface being proximate a portion of the coolant  
supply line upstream of the connection point, the first heat exchanging surface being proximate a  
supplemental external cooling source.

Claim 37. (New) The system of claim 36, wherein the thermo-electric subcooler is a peltier  
cooler.

Claim 38. (New) The system of claim 36, wherein the supplemental external cooling source  
includes a convective air cooler.

Claim 39. (New) The system of claim 36, wherein the supplemental external cooling source  
includes a heat sink.

Claim 40. (New) The system of claim 36, wherein the supplemental external cooling source  
includes a second compressor and a condenser.

Claim 41. (New) The system of claim 36, wherein the supplemental external cooling source includes a Joule-Thomson cooling device.

Claim 42. (New) The system of claim 36,  
wherein the thermo-electric subcooler is disposed in a system component external to the coolant supply unit.

Claim 43. (New) The medical cooling system of claim 42,  
wherein the system component is a connection box disposed along the coolant supply line upstream of the connection point.

Claim 44. (New) The medical cooling system of claim 43,  
wherein the connection box is an ECG connection box.

Claim 45. (New) The medical cooling system of claim 42,  
wherein the system component is attached to an external surface of the coolant supply unit.

Claim 46. (New) The medical cooling system of claim 36,  
wherein the controller is disposed in the coolant supply unit.